

California Regional Water Quality Control Board
Santa Ana Region

April 19, 2001

ITEM: 26

SUBJECT: Update on the Water Quality Assessment Program for the Anaheim Bay/
Huntington Harbour Complex

Discussion

Section 305(b) of the federal Clean Water Act requires the State to submit to the US Environmental Protection Agency (USEPA) a biennial report on the status of the state's water quality. To prepare the statewide report, each Regional Board completes a regional water quality assessment (WQA) that becomes a chapter in the statewide report submitted to USEPA. In the WQA, the Regional Boards identify waterbodies that are meeting water quality standards (water quality objectives and beneficial uses) and waterbodies that are not meeting standards. Those waterbodies identified as not meeting standards are placed on the Section 303(d) list, which triggers the need to develop a total maximum daily load (TMDL) for that waterbody and pollutant. As presented at the March 2, 2001 Board meeting, staff is in the process of preparing the 2002 update of the region's WQA and Section 303(d) list of impaired waterbodies on behalf of the State Water Resources Control Board. This effort will culminate in staff's recommended changes to the 303(d) list to be considered by the Board in the fall of this year.

For the long-term, staff continues to compile and collect water quality data for the Region's waterbodies, in order to comply with the Clean Water and prepare future (Year 2004/2006) assessments. As part of this effort, staff will implement a focused monitoring in the Anaheim Bay/Huntington Harbour complex (Anaheim Bay, Huntington Harbour). Monitoring in other watersheds will occur in subsequent years. The advantage of the focused approach is that the Board's limited monitoring resources are used to obtain adequate data for statistical purposes. The Anaheim Bay/Huntington Harbour complex was selected because of the limited amount of data available for these waterbodies and to verify the existing impaired status for these waterbodies. Anaheim Bay is included on the 303(d) list of impaired waterbodies for metals and pesticides; Huntington Harbour is included on the 303(d) list for metals, pesticides and pathogens.

Regional Board staff has been working very closely with staff of the Southern California Coastal Water Research Project (SCCWRP) to develop the monitoring program in the Anaheim Bay/Huntington Harbour Complex. The monitoring program design consists of a stratified random sampling approach that will enable staff to determine to a 95% confidence level whether a waterbody is impaired or not. Sampling will consist of conducting bioassays (toxicity tests) on the water column and sediment, water column and sediment chemical analyses including metals, pesticides and bacteriological components, and benthic infauna data (species composition and density). Sampling will

occur at 60 sites in the complex and is scheduled to be conducted in August 2001 and March 2002. This will allow for a comparison of dry and wet season conditions.

Specific goals of the Anaheim Bay/Huntington Harbour Water Quality Assessment are as follows:

- to determine the areal extent of both Anaheim Bay and Huntington Harbour that meet/do not meet water quality standards;
- to describe and depict spatial gradients of any measured exceedances;
- to determine the seasonal relationship between water quality and biological parameters;
- to assess the relationship between biological responses and contaminant exposure; and,
- to compare the data from Anaheim Bay with the data from other bays that have been studied using comparable monitoring program design.

One of the elements of staff's approach to completing the WQA is to partner with local volunteers and agencies to assist with the sampling program. This partnership will increase the knowledge of water quality issues by local volunteers, as well as assist Regional Board staff in sample collection. We see this also as a mechanism for increasing public knowledge about potential impacts we all have on the environment. In order to facilitate this partnership in the Anaheim Bay/Huntington Harbour complex, staff has been working with Orange County CoastKeeper to identify volunteers and to develop a training program. We anticipate that this public education and outreach component will involve volunteers assisting in recording data and taking field measurements such as pH and water temperature. Training workshops will precede all sampling events at which time Board staff will explain WQA protocols, the significance of the Basin Plan and water quality standards, pollution prevention strategies and sampling and data recording techniques. Public education and outreach will also consist of posting data obtained from the WQA on the Regional Board web-site.

Attached is the Anaheim Bay/Huntington Harbour WQA workplan that contains detailed information about the proposed sampling program.

Anaheim Bay/Huntington Harbor Water Quality Assessment Study

Workplan

1. Introduction

The Anaheim Bay/Huntington Harbor Complex is located on the northern edge of the Orange County Coast, approximately 20 miles southeast of Los Angeles. It receives a multitude of potentially degrading pollutants, such as heavy metals and organic chemicals from a variety of sources. These sources include boats and boating related activities; storm water/urban runoff; atmospheric deposition; agricultural runoff; and historical inputs. These sources can result in impairment of the beneficial uses. Beneficial uses include contact and non-contact recreation; navigation; biological habitat of special significance; wildlife habitat; rare, threatened or endangered species habitat; fish spawning; and marine habitat.

Section 305 (b) of the Clean Water Act requires the State to prepare and submit to EPA a report on the status of the state's ambient water quality. Each regional board prepares a regional water quality assessment (WQA), which then becomes a chapter in the statewide 305(b) report. The WQA identifies a list of the water bodies assessed, the pollutants of concern, and the potential pollutant sources. Water bodies identified in the 305(b) report as not supporting one or more beneficial uses are considered "impaired" and are then placed on the Clean Water Act Section 303 (d) list of impaired water bodies. Once included on the 303(d) list, the Clean Water Act requires that total maximum daily loads (TMDL) be developed to address the parameters responsible for impairment. Regional Boards prioritize the water bodies included in the 303(d) list for development of a TMDL. Water bodies are prioritized based on the degree of impairment, the number and type of beneficial uses impaired.

Anaheim Bay was listed in the 303(d) list for pesticides and heavy metals. Huntington Harbor was listed in the 303(d) list for pathogens, metals, and pesticides. The data necessary to determine if the Anaheim Bay/Huntington Harbor Complex should be listed for additional pollutants is very limited and inconclusive. A comprehensive monitoring program is needed to determine if the water quality objectives and / or beneficial uses are being met at the Anaheim Bay/Huntington Harbor Complex.

In the past, monitoring programs used to prepare the WQA have used sampling and analytical protocols that did not address large-scale questions of the entire water body. Some of these questions involve defining the number of acres, or percent of acreage, that meets a water quality objective (threshold). An appropriate monitoring program design that defines the percent area meeting a threshold has been used in offshore and other bay/harbor regions of Southern California. This monitoring design is a stratified-random sampling design with a

spatially systematic component. This design randomly allocates sample sites throughout the water body of interest resulting in an unbiased representation of water quality. Stratification within the water body enables us to compare one sub-region (sub-population or stratum) to another. Consequently, the study design was chosen for the assessment of ambient water quality in the Anaheim Bay/Huntington Harbor Complex. The goal of the study is to provide the information necessary to adequately assess the ambient water quality in the Anaheim Bay/Huntington Harbor Complex and to provide a baseline for future studies.

The Southern California Coastal Water Research Project (SCCWRP) developed the study design.

2. Focus of Work

This study focuses primarily on Anaheim Bay and Huntington Harbor. A map of the study area is included in Appendix A. This study does not include the Seal Beach Wildlife Refuge, the Bolsa Chica Ecological Preserve or Inner/Outer Bolsa Bay, which are separate water bodies that will be studied at a later time. Furthermore, assessment of the ambient water quality of the Bolsa Chica Ecological Preserve and the Inner/Outer Bolsa Bay will be addressed for the WQA by examining the data provided by CH2MHILL as a result of the Bolsa Chica Wetlands Restoration Project currently underway. Additional sampling at the Bolsa Chica Wetlands may be conducted as a separate component of the upcoming Southern California Bight (Bight) 2002 Regional Monitoring Project.

3. Study Design and Objectives

The overall goal of the study is to attain a comprehensive and current assessment of the water quality in Anaheim Bay/Huntington Harbor Complex.

The objectives of this monitoring study are:

- Define the extent (percent of area) and magnitude of deviation from thresholds.
- Describe and depict spatial gradients of contaminants
- Determine seasonal relationships (i.e. dry vs. wet seasons)
- Assess the relationship between biological responses and contaminant exposure
- Compare Anaheim Bay with the bays sampled by the Bight '98 Monitoring Program

Sampling will take place in March and August 2001. These months were chosen to represent ambient water quality during both the wet and dry seasons. Sampling in March will allow us to determine the ambient water quality in the wet season after storm events have occurred. The sampling date for March will be

chosen so that it does not coincide with a storm event, or immediately after a storm event so that the data will represent a period of time when the indicators are expected to remain stable (ambient water quality). Sampling in August will allow for direct comparison with Bight '98 data.

The two strata selected for the study are Anaheim Bay and Huntington Harbor. These strata were chosen because it is suspected that the water quality in the bay will be different than the water quality in the harbor. For example, the bay is subject to more tidal influences, flushing and mixing than the harbor.

This monitoring study will involve sampling 60 sites in the Anaheim Bay/Huntington Harbor Complex (30 sites per stratum). As stated above, the sampling sites were selected using stratified-random sampling design with a spatially systematic component. A list of the sampling sites is included in Appendix B. Thirty sites were allocated per stratum to ensure that the 95 % confidence interval is no larger than 15% of the subpopulation area assuming about 20% impairment.

Sampling sites were selected randomly within each stratum, rather than by investigator pre-selection, to ensure representative sampling. The number of sites in Appendix B exceeds the original 60 sites by 50%. The reason for the increase is that it may not be possible to sample all of the randomly selected sites because of improper substrate type, depth restrictions, or dredging activities. To prevent an unacceptable loss of statistical power due to lost samples the number of sites allocated was increased by 50%.

Although sites were selected randomly, a systematic component was added to the selection process to minimize clustering of sample sites. The systematic element was accomplished by using an extension of the sampling design used in the Southern California Coastal Bight Pilot Project and in EPA's Environmental Monitoring and Assessment Program (EMAP). A hexagonal grid was placed over a map of the sampling area. The hexagonal grid structure ensures systematic separation of the sampling, while the random selection of sites within grid cells ensures an unbiased estimate of ecological condition.

4. Indicators

Water bodies are complex systems. Sediments interact with the water column. The interaction includes deposition of heavy metals, organic chemicals, phosphorus and nitrogen into the bottom sediments. The interaction can also include re-suspension of these materials from the sediment into the water column. The interaction may take place as a result of changes in pH, dissolved oxygen, temperature, and wave patterns among others. This interaction may include the potential release of various forms of nitrogen, phosphorus, solubilized metals, and organic materials such as pesticides into the water

column. Sediments are also habitats for various organisms which in turn are predated by higher organisms.

As a result of this interaction and to assess the overall water quality of the Anaheim Bay/Huntington Harbor Complex, this study includes sampling and analyses of the sediment and the water column. In addition, the status of the organisms residing in the sediments will be investigated to gain an overall picture of the interaction between the water column and the sediments and help determine the impact on the sediment dwelling organisms. Comparison of the sediment chemistry, biology, and toxicity with water column measurements and toxicity consist of the weight of evidence approach to water quality assessment.

Uniform sampling and analytical methods will be conducted throughout Anaheim Bay/Huntington Harbor. Toxicity data will be correlated with chemistry and benthic infauna data for sediments and with chemistry for water column samples.

The Anaheim Bay/Huntington Harbor Water Quality Assessment Study will measure multiple indicators (Table 1) at each site to relate contaminant exposure with biological response, and habitat conditions. These indicators were selected based on the following:

- the overall objectives of the study,
- the beneficial uses and the water quality objectives listed in the 1995 Basin Plan for the Santa Ana Region,
- the indicators for which a threshold is available, and
- the indicators sampled by the Bight '98 monitoring program.

It is expected that the sediment chemistry, toxicity and benthic infauna won't exhibit a significant difference between the March 2001 and the August 2001 months. Consequently, these analyses will be performed only in August. The March 2001 sampling activities will include water column toxicity, and physical measurements. The August sampling activities will include water column toxicity, physical measurements, benthic infauna identification, sediment chemistry and sediment toxicity.

5. Sampling and Analyses Methods

- Sediment Chemistry:

Chemical analyses of the sediment samples provide an assessment of chemical deposition. Sediment chemistry will allow us to determine the chemicals that are present and their respective concentrations; which might not be in a bioavailable form. (If these chemicals are not in bioavailable form then they are of no biological concern). Sediment samples will be collected from the top 2cm using a 0.1m² modified Van Veen grab sampler. A list of the analyses that will be performed on the sediment samples is on Table 1.

Sediment chemistry samples will be collected and analyzed in August 2001.

- Sediment Toxicity:

Sediment toxicity will allow us to determine if there is a direct impact to the exposure of the chemicals found in the sediment. Sediment samples for toxicity analyses will be collected from the top 2cm using a 0.1m² modified Van Veen grab sampler. Amphipod (*Eohaustorius estuarius*) sediment bioassays will be conducted on the 60 sediment samples collected in August 2001 from Anaheim Bay/Huntington Harbor. The endpoint of the test is survival of the amphipod after a ten days exposure to the sediment sample.

- Benthic Infauna:

Benthic infauna (organisms that live in the sediment) are an important part of the marine food web. They generally reside in one location for most of their life and are chronically exposed to sediment contaminants. Consequently, benthic infauna are excellent indicators of environmental water quality. Samples for infauna analyses will be taken using a Van Veen grab sampler. The benthic infauna analyses will consist of sorting and taxonomic identification, to the species level, of the organisms found in the sediment. The sediment samples will be collected using a 0.1m² modified Van Veen grab sampler and sieved in the field to 1.0 mm. The benthic infauna samples will be collected in August 2001.

- Water Column Chronic Toxicity:

Water column samples will be collected using a water-column depth integrator sampler. Kelp (*Macrocystis pyrifera*) germination and growth, red abalone (*Haliotis rufescens*) larval development, and purple sea urchin (*Strongylocentrotus purpuratus*) fertilization bioassays will be performed on undiluted samples collected from Anaheim Bay in March 2001 and in August 2001. The chronic toxicity analyses will include all required reference toxicant testing on the three species listed above. The endpoints for these analyses are as follows:

Species Tested	End point of Analyses
Kelp	Germination and Growth after 48 hour exposure
Abalone Larva	Larval development after 48 hour exposure
Purple Sea Urchin	Embryo fertilization after 2 hour exposure.

- Water Column Field Measurements:

As stated above, the interaction between the water column and the sediments results from changes in physical parameters such as pH, dissolved oxygen, and temperature. Therefore, it is important to measure these parameters during the sampling activities. A YSI 6920 multi-parameter probe will be used to measure pH, dissolved oxygen, temperature, pH, salinity, bottom depth, turbidity, total suspended solids, and chlorophyll a. The multi-parameter probe will be calibrated the same day as the sampling activities. These measurements will be taken in March and in August 2001.

6. Responsible Parties

The overall goal of this study is to obtain statistically significant data that is scientifically valid to assess the water quality in the Anaheim Bay/Huntington Harbor complex. There is also an opportunity for public outreach including:

- 1) educating the public about the water quality impacts to the bay and harbor from anthropogenic activities,
- 2) informing the public of the water quality assessment report, and
- 3) encouraging stewardship of the area.

In order to carry out the goal and objectives of this study, the Regional Board will be working with various agencies and contractors including SCCWRP, ABC Laboratories, CRG Marine Laboratories, and the Coast Keeper to carry out the monitoring program. The following outlines the roles of each of the participating parties in this monitoring study:

- Santa Ana Regional Water Quality Control Board's Role:
 - Obtain the necessary permits to access the sampling sites and collecting samples
 - Collect samples per protocols specified by the Quality Assurance Plan for Bight '98 and the laboratories participating in this study
 - Ensure that all necessary chain of custody forms are completed prior to surrendering samples to the laboratory
 - Obtain the necessary funding to carry out the study
 - Coordinate with all parties involved in the study
 - Coordinate with SCCWRP for data analyses and payment of analytical services.
- Coast Keeper's Role:
 - Organize community volunteers.
 - Assemble informational pollution prevention material for the volunteers
 - Coordinate meetings and training sessions with the volunteers

- Provide a registered boat with an A frame and winch
- SCCWRP's Role:
 - Provide the core monitoring design for the study (list of the sampling sites, list of indicators, map of the study area depicting the sampling sites, etc)
 - Provide Van Veen grab sampler
 - Coordinate with the laboratories for analyses of samples
 - Coordinate with the laboratories to obtain the data for analyses
 - Analyze the data
 - Compile the data and write a report on the conclusions of the study.
 - Provide the Regional Board with the database, data analyses and written report
- CRG Marine Laboratory's Role:
 - Provide training to regional board staff and volunteers for collection of samples
 - Provide the necessary containers, preservatives, chain of custody forms for the samples.
 - Oversee the sample collection.
 - Transport the samples to the laboratory for processing.
 - Analyze the samples for sediment chemistry, and water column chemistry.
- ABC Laboratory's Role:
 - Provide training to regional board staff and volunteers for collection of samples.
 - Provide the necessary containers, preservatives, chain of custody forms for the samples.
 - Oversee the sample collection.
 - Transport the samples to the laboratory for processing.
 - Analyze the samples for water column and sediment toxicity, and benthic infauna.
- Volunteers:
 - Record data
 - Label the sample bottles
 - Assist in sample collection

Equipment:

The boat necessary for the study will be equipped with an A-frame and a winch capable of handling the 0.1m² modified Van Veen grab sampler. The Coast Keeper will supply the boat. The Van Veen grab sampler will be used to collect

the sediment samples for benthic infauna characterization, sediment chemistry, and sediment toxicity analyses. The water column samples will be collected using a depth integrator sampler that collects a composite sample of the water column. Field measurements of the water column will be taken by using a YSI 6929 multi-parameter probe. The probe will be calibrated the same day the measurements will be taken. Calibration date and measurements will be recorded in a waterproof field log. While on the boat, the locations will be verified by using a handheld GPS.

Chain of Custody or Field Methods

The Regional Board will be responsible for tracking all samples collected during the study. Chain of custody forms will be used to track each sample from the time it is collected to its final destination in the laboratory. The field crew will complete a chain of custody form in triplicate for each set of samples to be transferred to the laboratory. This form will be signed by the crewmember transferring the samples. Subsequently, the laboratory staff member will sign the chain of custody form. A copy of the chain of custody form will be kept in the Regional Board Water Quality Assessment 2001 File and the original will accompany the samples. The third copy will be forwarded to SCCWRP.

7. Quality Assurance and Quality Control

Quality assurance/quality control (QA/QC) is an important part of any environmental monitoring project. A carefully planned QA/QC program ensures that the data collected are scientifically valid and adequate to meet the goals of the study.

Quality assurance activities for the study are outlined below:

- Standardization of sample collection, processing, and analytical methods
- Training workshops for field personnel by CRG Laboratories and ABC Labs.

The quality control activities are outlined below:

- CRG Marine Labs and ABC Labs staff will be present during the sample collection activities to ensure that the samples are collected in accordance with Bight '98 protocols.
- Sample processing and analyses will follow the Bight '98 Quality Assurance Plan.

8. Data Management and Data Availability

Field and laboratory data will be reported to SCCWRP by CRG Marine Laboratories and ABC Laboratories for input into their database in accordance with the Bight '98 Information Management Plan. SCCWRP will store the data in the same database structure that was developed and used in the Bight '98 Monitoring Survey. A sample of the database structure is included in Appendix C.

SCCWRP will forward the formatted data set to the Regional Board upon completion of a report describing the conclusions of the study. The final data set will be stored in Microsoft Access 97 and in Storet Version 1.1 at the Santa Ana Regional Water Quality Control Board.

All data from this study will be available to the public via the Santa Ana Regional Water Quality Control Board's website (WWW.SWRCB.CA.GOV/RWQCB8).

9. Project Reporting

A water quality assessment report, in draft form, specific to the Anaheim Bay/Huntington Harbor Complex describing the conclusions of the study will be available through the Regional Board's website for review and comment. The final report will address any comments received and will be available to the public through the Regional Board's website.

Indicators Table 1:

Indicator	Sediment	Water Column
Benthic infauna taxonomy	✓	
Toxicity	✓	✓
Arsenic	✓	
Cadmium	✓	
Chromium	✓	
Copper	✓	
Iron	✓	
Lead	✓	
Mercury	✓	
Nickel	✓	
Silver	✓	
Zinc	✓	
Acenaphthene	✓	
Acenaphthylene	✓	
Anthracene	✓	
Benz[a]anthracene	✓	
Benzo[a]pyrene	✓	
Benzo[b]fluoranthene	✓	
Benzo[e]pyrene	✓	
Benzo[g,h,i]perylene	✓	
Benzo[k]fluoranthene	✓	
Biphenyl	✓	
Chrysene	✓	
Dibenz[a,h]anthracene	✓	
Fluoranthene	✓	
Fluorene	✓	
Indeno(1,2,3-c,d)pyrene	✓	
Naphthalene	✓	
Perylene	✓	
Phenanthrene	✓	
Pyrene	✓	
2,6-Dimethylnaphthalene	✓	
1-Methylnaphthalene	✓	
2-Methylnaphthalene	✓	
1-Methylphenanthrene	✓	
1,6,7-Trimethylnaphthalene	✓	
LMW PAH's	✓	
HMW PAH/s	✓	
Total PAH/s	✓	
Chlordane	✓	
PCB Congeners	✓	
Total DDT	✓	
4,4'-DDT	✓	
2,4'-DDT	✓	
DDT	✓	
4,4'-DDD	✓	

Indicator	Sediment	Water Column
2,4'-DDD	✓	
DDD	✓	
4,4'-DDE	✓	
2,4'-DDE	✓	
DDE	✓	
Salinity		✓
Bottom Depth		✓
Light Transmission (turbidity)		✓
Total Suspended Solids		✓
Oxygen Saturation		✓
Bacteria		✓
Visual inspection for sheen (oil & grease)		✓
Total Organic Carbon	✓	
Grain size	✓	
Acid Volatile Sulfides and simultaneously extracted metals (SEM)	✓	
Percent Solids	✓	
Dissolved Oxygen (vertical profile)		✓
pH (vertical profile)		✓
Temperature (vertical profile)		✓
<i>Chlorophyll a</i> (vertical profile)		✓
Specific conductance (vertical profile)		✓